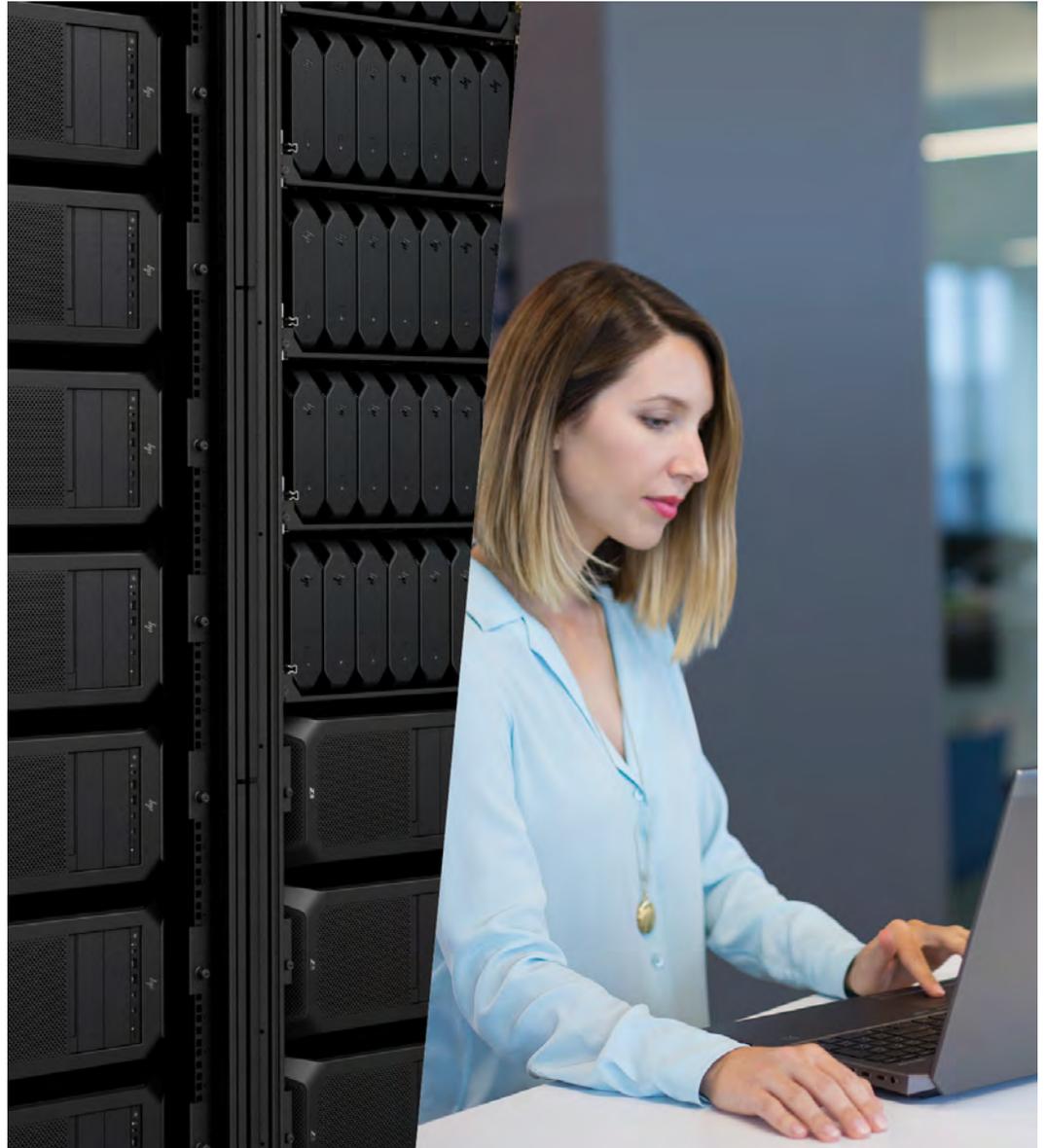




TECHNICAL WHITE PAPER

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HP ZCENTRAL NAS WORKSTATION SOLUTION

EXECUTIVE SUMMARY

This paper is meant to outline how Z Desktop Workstations can be, and are in many cases well suited to be, Network Attached Storage (NAS) devices. With platforms such as the Z8 G4, you may be surprised that you could fit both 40TB or more of NVMe, and 36 TB or more of SATA storage, AT THE SAME TIME! All this storage, while still having a high-speed network interface through the HP Z Dual 10GbE Network Module.

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WHY SOMEONE MIGHT USE A Z WORKSTATION AS A NETWORK ATTACHED STORAGE WORKSTATION

HP has had a history of customers using Z Workstations as NAS Workstations for years, however in the past we have not specifically marketed this use model. Certain customers have naturally gravitated to the Z Workstations as NAS solutions due to the high configurability, especially with the World's Most Powerful Workstation, the Z8 G4.

Having the ability to support HDD, SSD, and/or NVMe drives with various RAID configurations allows for Z Workstations to serve up large volumes of storage. In general, when comparing the cost of a Z Workstation configured as a NAS workstation, compared to traditional NAS products, the cost per TB and the performance becomes very compelling.

Centralizing your storage is not the right solution for everyone, but in many cases with ZCentral deployments, it makes sense for many reasons. Reasons which will be explored in later sections.

Z NAS as part of the ZCentral solution

A ZCentral Solution can include both brokered and private computing hosts.

In a brokered environment the computing hosts within a pool are dynamically assigned to users.

Since computing hosts are dynamic, the use of permanent local storage is often limited if not prohibited altogether by group policies. This is where the importance of secure high-performing network storage is necessary. Within this environment both application and profile data must be accessed, copied, modified, and shared over a network.

It is also often the case where application and project data must be shared among multiple computing hosts and users whether they are configured in a brokered pool or private hosts. A single master representation of the data is required so that multiple users can access and if needed modify.

Using a Z storage solution in a ZCentral computing environment extends the benefit of using a single workstation supplier solution for computing, storage, brokering, remoting, and client mobile display.

Benefits of centralizing storage

Some benefits to centralizing storage are obvious, however others may not be.

Security is one of the more obvious benefits, being that you can keep all of your sensitive data in a locked area and you can control that data in one location opposed to having it spread out over multiple systems. Furthermore, features such as the HP Solenoid Hood Lock and Hood Switch, allow you to control physical access into the unit and understand when the side panel has been removed. Additionally, you can disable external USB ports through BIOS to further prevent local access to the data if your NAS system is somehow accessed. By creating a system where there is only one way in or out (being the network port(s)), you can securely control your data.

One of the less-obvious benefits to centralizing your storage is individual user performance. We have had customer deployments where configuring a NAS workstation with a RAID 0 NVMe storage volume and supplying sufficient network bandwidth to client systems yields better read and write bandwidth than if each client system was accessing the same data from a local NVMe device (the performance benefit being with the large RAID 0 volume). In the same fashion, the total cost of storage is less than if each individual client had an NVMe drive, which brings us to the next benefit.

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Total cost of storage, when talking about centralizing storage for a pool of client systems, is a matter of total volumes needed and the total number of clients accessing the central storage unit. For instance, if you were to have a single NAS system serve three or four clients, the total cost of ownership may be higher than if you didn't have that NAS system. However, when you start adding up the numbers for a large client pool, say a dozen or more systems (only rough numbers are given as it entirely depends on the types and volumes of storage involved), then in many cases the total cost of storage can be much less than if you didn't centralize your storage.

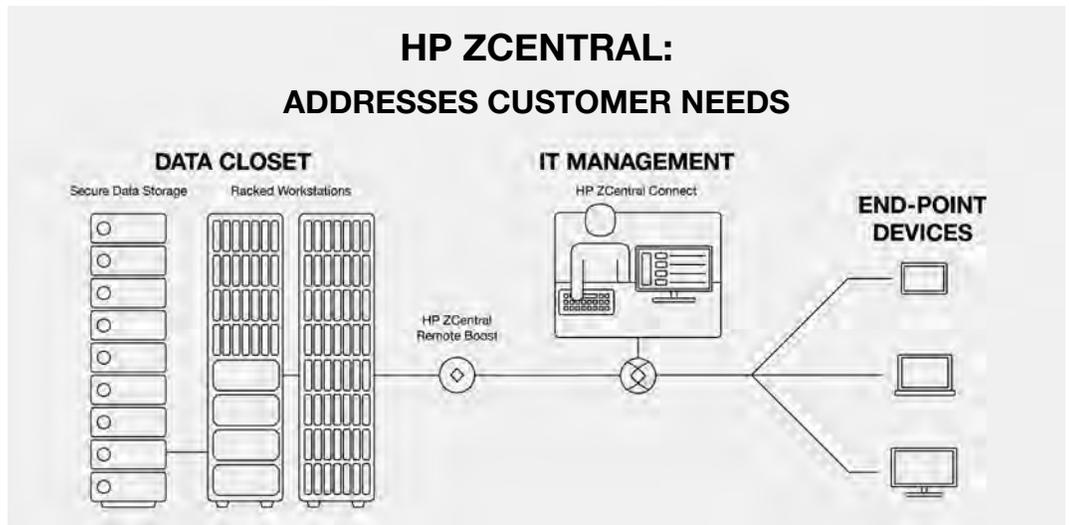
Something else to consider with centralizing your storage into a NAS workstation, is that with the processing power of a Z Workstation, you can often not only serve up your files, but in parallel you can host your machine learning (ML) or artificial intelligence (AI) processing. This said, you should work to carefully understand the CPU or GPU processing power required to deploy for AI or ML algorithms, in conjunction with the expected NAS workload.

NAS Architecture overview

NAS systems come in many different shapes and sizes, ranging from home NAS appliances used as media servers or storage for your hundreds of cat pictures, to enterprise-class storage servers. For the purpose of this paper, we will stick to the basics that would apply to using a Z Workstations for your NAS needs.

In terms of hardware architecture of a NAS workstation, you need a processor to process the network-storage transfers, you need system memory to stage data for transfers, you need some sort of storage, and you need a network connection. In this section, we won't get into details about how each individual hardware component behaves in a NAS deployment, but instead we will cover something to keep in mind as you're configuring your Z Workstation as a NAS workstation, being that you need to watch out for bottlenecks.

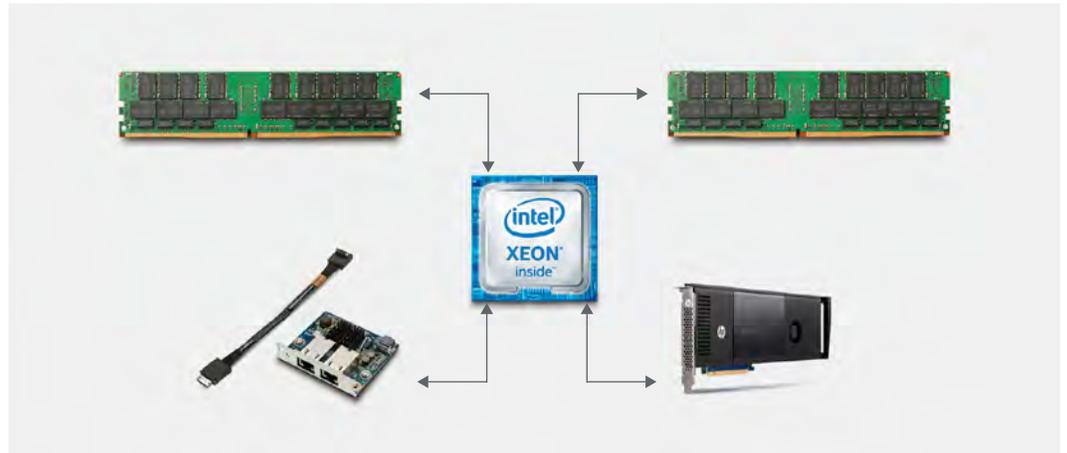
Block Diagram of Network Architecture



With the ZCentral solution, your data is kept close to your Z Workstations, which are consuming that data. In this topology the data can be on a separate network or sub-network from the WAN connection that allows end-point devices to connect via ZCentral Remote Boost. In this manner, you can keep your data only accessible through your racked workstations. Most modern Z Workstations either have two LAN-on-motherboard Gigabit ports, or there is an option for two LOM Gigabit ports. Furthermore, the Z8 G4 and Z6 G4 systems can be configured with the Z Dual 10GbE Network Module, which does not use a PCIe slot. This is all important when configuring your NAS system, as the more PCIe slots you have available, the more PCIe storage you can load. If more network bandwidth is required than what you can do with LOMs, then there are several network adapter offerings to suit your particular needs, which is outlined in the section on **Network Adapter Options**.

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Components of a NAS System, simplified



The above figure shows all of the components we just described. Something to keep in mind, is that all data coming into, and going out of, the NAS will need to travel through the network interface, be processed by the CPU, be temporarily stored in the RAM, and then be written to, or read from, the storage. With all this in mind, it is imperative not to design bottlenecks into your configuration if possible.

We won't get into details but depending on the number of clients that will be accessing the storage on your NAS, you will want to use a network option that doesn't restrict concurrent access by your users. Depending on the amount of traffic and number of users, you will need to ensure the processor(s) you select can keep up with number of concurrent requests to read or write from the storage. Similarly, since data traveling in or out of the NAS makes a trip through system memory, you want to avoid the memory filling completely, which will cause transfers to halt until memory is freed up.

Now the important part comes in with your storage, where if the rest is configured to avoid bottlenecks, your storage should be the only bottleneck you have. Meaning, you want to configure the network interface, CPU, and memory to have enough bandwidth and performance to keep up with the read and write performance of your storage. If you're using HDD's as your storage, you can often "go cheap" on the network, CPU, and memory, but if you are using NVMe, you'll want to have some muscle to support the performance. If you want to RAID 0 or RAID 10 your NVMe, you'll need to bulk up that muscle even more! The truth is, you will see the true benefits of using a Z Workstation as a NAS when you configure a large RAID volume of NVMe and have the appropriate muscle to feed it.

Again, we aren't going into details of what sort of configuration you should go with, but rather we want you to know what to look out for and think about when configuring your NAS.

Platform options to consider

When selecting a platform to deploy as a NAS workstation, you can use any of the Z Desktop Workstations, however due to the configurability and capabilities of the Z4, Z6, and Z8 platforms, we will focus on those platforms for the purpose of this paper. Something to consider with any option is that most NAS workstations do not require much in the form of graphics resources, and so any graphics option is suitable. We will break down the benefits of each platform in the following subsections.

With any of the platforms used as a NAS, it is possible to designate all available PCIe slots to be used for NVMe, to maximize the NAS performance and total NVMe volume. It is recommended to use SATA drives for the boot drive of your NAS, and in all of the recommended configuration below, the boot drive can be configured as a RAID1 to reduce the likelihood of a boot drive failure bringing down your NAS. It is not recommended to use a partition from your primary data storage drives for the boot partition.

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The following table outlines the capabilities of each platform, specific to what matters most in NAS workstation configurations:

Platform	CPU Cores	Memory Capacity	SATA Bays	PCIe Slots ¹	Dedicated NVMe Slots	Max NVMe Devices ²
Z8 G4	28 + 28	3 TB	2 x 3.5" ¹ 2 x 5.25" EXT	9 ³	4 ^{3,5}	20 ³
Z6 G4	28 + 28	768 GB	2 x 3.5" ¹ 2 x 5.25" EXT	6	2	11
Z4 G4	18	256 GB	2 x 3.5" ¹ 2 x 5.25" EXT	5	2	10

Notes:

- ¹ Dedicated internal storage bays, which can house either a 3.5" or 2.5" SATA drive.
- ² Maximum NVMe devices implies all available PCIe slots and M.2 M-Key slots are utilized for NVMe SSDs, after a graphics card is installed in a x16 slot, according to slot loading recommendations.
- ³ This assumes the 2nd CPU is installed to make the PCIe lanes available.
- ⁴ PCIe slots refers to the total number of PCIe slots, which does not discount the PCIe slot used for a discrete graphics card. There are options for headless (no discrete graphics card installed), which may free up to 16 lanes of PCIe for additional NVMe, but this is not accounted for in the Max NVMe Devices number, as stated in Note 2. Additionally, a graphics card may be installed in a x4 PCIe slot, which could free up to 12 additional PCIe lanes, while still having a graphics interface. These options are not often Configure to Order (CTO) are up to a customer to manage.
- ⁵ The dedicated NVMe slots on the Z8 G4 refer to the Personality Slots, which are designed to support two NVMe devices per x8 PCIe slot.

All of the Z Workstations have the ability to be rack mounted with one of the various HP rack mounting kits (see the **Rack Mounting and The HP Workstation white paper** for more information).

Z8 G4



Being the World's Most Powerful Workstation, the Z8 G4 is what most customers currently using Z Workstations for NAS workstations, typically use. The Z8 G4 has enough CPU and memory options to handle any workload you can throw at it, and the majority of the PCIe resources in the system can be used for PCIe storage. Also, the Z8 G4 has the most SATA drive bays of all the Z Workstations.

The Z8 G4 also has support for the HP Z Dual 10 GbE Network Module, which offers two 10 GbE ports without taking up a standard PCIe slot. This may be ideal for NAS implementations that only

require one or two 10 GbE network interfaces, and the ports can additionally be teamed for failover or link aggregation purposes. With the HP Z Dual 10 GbE Network Module, it is important to note that the maximum possible theoretical bandwidth is 16 Gbps, due to the HP Z Dual 10 GbE Network Module having two PCIe Gen3 lanes servicing the module. In most cases, this limitation will not impact customers, but of course in some cases this bandwidth may be continually maxed out.

When the Z8 G4 is mounted in a rack, please allocate 5U of space for each unit.

For more information about the Z8 G4 platform, check out the **HP Z8 G4 Workstation QuickSpecs**.

Z6 G4



The Z6 G4 platform is ideal when deploying a NAS workstation where you do not have plans to maximize the PCIe slot, CPU, or Memory usage initially, but you want the ability to upgrade over time as needs change. For instance, the Z6 G4 enables a second CPU and six additional DIMMs to be installed after the initial purchase. Specifically, if the CPU and memory resources are not expected to be taxed initially, but after some amount of time the NAS workstation may have more users accessing it, for example, then a second processor and additional memory may be added later to support the increased workload demand.

The Z6 G4 also supports the HP Z Dual 10 GbE Network Module, which frees up a PCIe slot for NVMe devices. All the notes on the HP Z Dual 10 GbE Network Module in the Z8 G4 section, also apply to the Z6 G4.

When the Z6 G4 is mounted in a rack, please allocate 4U of space for each unit.

For more information about the Z6 G4 platform, check out the **HP Z6 G4 Workstation QuickSpecs**.

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Z4 G4

The Z4 G4 platform has roughly the same storage capabilities as the Z6 G4 platform, but as a single-CPU platform, it is not capable of adding a second CPU or additional memory. It is also a more affordable option for most wanting to build a NAS workstation.

Compared to the Z6 G4 and Z8 G4, the Z4 G4 does not have an option to support the HP Z Dual 10 GbE Network Module, so a PCIe slot must be used to get more the 2 Gbps of network bandwidth (from the two on-board Gigabit ports). When the Z4 G4 is mounted in a rack, please allocate 4U of space for each unit.

Storage options

All the Z Workstations have a wide variety of storage drives supported, including HDD, SSD, and NVMe drives. In the case of, the Z6 G4 and Z8 G4 platforms, a new type of storage is supported in the form of Intel® Optane™ DC Persistent Memory. With persistent memory, new levels of NAS performance may be achieved, however at the time this paper was written, the technology is not evolved enough to give recommendations for a NAS workstation with persistent memory.

In terms of storage, this paper is only meant to cover the storage options and considerations when configuring your Z NAS workstation. Along those lines, some things to keep in mind, are that depending on the user workloads and network infrastructure support, you can achieve better user storage performance with centrally located and shared storage. For example, if you were to look at the storage performance of individual workstations each with a single NVMe drive to work from, and compare that performance to a Z NAS with several NVMe devices set up in a RAID 0 or RAID 10, over a 10 GbE network infrastructure, you may be surprised to find that storage performance is better in the NAS model. In addition to the performance, having all of the data centralized comes with the added benefit of having tighter control over the data, redundancy policies can be enforced, and the storage devices become easier to manage and service.

Something to keep in mind with selecting storage for your Z NAS workstation, is what you intend to use the storage for. If it is meant for archival purposes, then having several HDD's may make sense. If you plan to have a portion of the data accessed confidently, then you may want to design for performance with SSD's or NVMe. Another beautiful thing about using Z Workstations for NAS, is that you can have both SATA and PCIe-based storage arrays. Meaning, you can have the same NAS serving up both archive volumes and high-performance storage volumes. With traditional enterprise storage servers, you often have to choose between either primarily SATA or primarily PCIe-based storage interfaces.

The following table summarizes the current maximum drive configurations and capacities, looking again at the Z8 G4, Z6 G4, and Z4 G4 platforms:

Platform	SATA Ports ¹	Max SATA Capacities ⁵	SATA Bays	PCIe Slots ⁴	Max NVMe Devices ²	Max NVMe Capacities ⁵
Z8 G4	8	6 x 6 TB (36 TB)	2 x 3.5" 2 x 5.25" Bays	9 ³	20 ³	40 TB
Z6 G4	6	4 x 6 TB (24 TB)	2 x 3.5" 2 x 5.25" Bays	6	11	22 TB
Z4 G4	4	4 x 6 TB (24 TB)	2 x 3.5" 2 x 5.25" Bays	5	10	20 TB

Notes:

¹ Additional SATA ports can be added with an add-in PCIe card, and additional SATA drive enclosures can be located in the external 5.25" bays.

² Maximum NVMe devices implies all available PCIe slots and M.2 M-Key slots are utilized for NVMe SSDs, after a graphics card is installed in a x16 slot, according to slot loading recommendations. More devices may be loaded if the graphics card is installed in a x4 or x8 slot, opposed to the recommended x16 slot.

³ This assumes the 2nd CPU is installed to make the PCIe lanes available.

⁴ PCIe slots refers to the total number of PCIe slots, which does not discount the PCIe slot used for a discrete graphics card. There are options for headless (no discrete graphics card installed), which may free up to 16 lanes of PCIe for additional NVMe, but this is not accounted for in the Max NVMe Devices number, as stated in Note 2.

⁵ When describing the maximum SATA or NVMe capacities, the numbers given are for supported devices as of the published date of this white paper. Larger storage devices can be installed by HP Configuration Services if desired.

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SATA options

When configuring a NAS workstation with SATA drives, you can either go for long-term storage (AKA archival data), which would suggest the use of HDD/rotational media for the low cost/GB. Alternatively, you may want to configure your SATA array to be SSD's or even Self Encrypting Drive (SED) SSD's if you prefer that added layer of security.

Whichever SATA configuration option you choose, be sure to reference the QuickSpecs for the respective platform you want to use for a list of supported SATA drives. Additionally, if there is a SATA drive option that is not available, you can always talk to your HP Sales Representative about having HP Custom Services incorporate the drives you need. In this manner you may be able to achieve higher SATA storage volumes than what you can get CTO.

NVMe options

When it comes to NVMe options for Z Workstations, there are two classes, being ZTurbo drives and Intel® Optane™ SSDs. When it comes to Intel® Optane™ SSDs, these cards come in a standard PCIe card with an optional low-profile bracket. It is recommended to install these cards in an available x4 PCIe slot. With ZTurbo drives, which are essentially M.2 form factor x4 PCIe NVMe SSDs with HP firmware to enable enhanced features, you can install them in both on-board M.2 M-key slots as well as one of the M.2 carrier cards. The HP ZTurbo PCIe cards can be configured to support one to four drives, with the HP ZTurbo Dual Pro and HP ZTurbo Quad Pro. For more information about configuring these cards, please see the **HP ZTurbo Quad Pro and Dual Pro QuickSpecs**. Something to consider if you are concerned about power losses corrupting your data, is that with the ZTurbo Quad Pro, the card comes with super capacitors that when a power loss event is protected, the card is still powered long enough to clear caches and greatly reduce the likelihood of data loss or corruption as a result of the power loss event.

RAID configurations and Intel® VROC

Just about any reasonable NAS workstation configuration will have some form of RAID array. In many cases, multiple RAID arrays may be implemented. For instance, you may dual purpose your NAS workstation as both active storage (storage that is used frequently for active tasks) and archival storage (storage space that is meant to archive completed work or source files). The Z8 G4 platform, having a rich configuration for both large NVMe capacities as well as large SATA arrays, lends itself nicely to this dual RAID configuration, where a NVMe RAID is configured for active tasks of distributed users, and the SATA RAID is configured for archive space.

Whether you need 40 TB of NVMe or just 10 TB, you may want to consider configuration options that have a large set of drives, versus a few very large drives. For instance, if you configure five 2 TB NVMe drives, and form a RAID 0 to give a total volume of 10 TB, and compare that to ten 1 TB NVMe devices to form the same size volume, then you may achieve up to double the performance with the ten drives versus five drives. Of course, the overall performance is dependent on the workload, but the aggregate bandwidth at any rate is double when comparing 5 times PCIeG3 x4 versus 10 times PCIeG3 x4.

Something else to consider if using RAID 0, is that it is common to reserve a drive as a hot spare, which should be accounted for when configuring your NAS workstation for a specific total capacity.

On the Z8 G4, Z6 G4, and Z4 G4 platforms, Intel® Virtual RAID On CPU (VROC) is supported, which can greatly enhance your NVMe-based NAS workstation configurations. The VROC functionality can be tested on a temporary basis, being enabled through BIOS F10 Menus, but for long term use, a VROC module must be purchased (Standard: 3FJ80AA or Premium: 3FJ81AA). For more information about Intel® VROC, please see the **Intel VROC for NVMe QuickSpecs**.

Network options

When using any of the Z Workstations as a NAS workstation, there are several network options with each platform. Whether you just need a single Gigabit port, or you need 10's or 100's of Gbps for your network interface, there are options to get you the network performance you need.

When designing your NAS, it's important to try and match your network bandwidth with the storage and processing performance. In case you skipped it, go back and read the **Components of a NAS System, Simplified** section. The bottom line is that you should avoid configuring a system with exceptionally fast storage and ample processing power, but then connect your NAS with a single Gigabit link. It is best to match the network capability with the storage and processing performance, based on your expected workload and number of users accessing the NAS at the same time. With that in mind, we will now cover the networking options available, and with many of the options, you can combine network adapters to scale your network bandwidth.

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Network Adapter options

For a detailed breakdown of networking options that can be used with Z Workstations, you can reference the **Networking Adapters for HP Workstations QuickSpecs**. For the purpose of designing your NAS workstation, we will simply summarize the options and cover some networking considerations for optimizing your NAS.

Something important to consider is that a NAS workstation can be deployed either on a wired/LAN or wireless/WLAN network. All Z workstations have a WLAN/Bluetooth network adapter, which may be used as the primary interface, or as an alternate interface into your NAS. In general, most NAS instances are expected to be in a racked configuration, and in those cases, there are several viable LAN configurations.

Another important consideration is that in some NAS workstation instances, network bandwidth needs may exceed what any of our CTO or After Market Options (AMOs) can support. When this is the case, the HP Configuration Services team can integrate the network adapter of your choosing to get the bandwidth you need. It is encouraged that you speak with your HP Sales Representative to get more information on HP Configuration Services options.

The following table summarizes the network adapter options, alongside the LAN on Motherboard (LOM) interfaces on each of the recommended platforms covered in this paper:

Platform	LOM ¹	Gigabit Adapters ²	10 GbE Adapters	WLAN Adapter
Z8 G4	2x1GbE	I210-T1 I350-T2 I350-T4	HP Z Dual 10 GbE NM X550-T2 (RJ45) X710-DA2 (SFP+)	Intel® AX200 (Wi-Fi 6)
Z6 G4	2x1GbE	I210-T1 I350-T2 I350-T4	HP Z Dual 10 GbE NM X550-T2 (RJ45) X710-DA2 (SFP+)	Intel® AX200 (Wi-Fi 6)
Z4 G4	2x1GbE	I210-T1 I350-T2 I350-T4	X550-T2 (RJ45) X710-DA2 (SFP+)	Intel® AX200 (Wi-Fi 6)

Notes:

¹ The LOM capabilities shown are the top speed for each port. In some cases there are more speeds supported by each LOM port.

² All Gigabit adapters are RJ-45 interfaces. All interfaces are RJ-45, unless otherwise noted.

Teaming Ports

Teaming of you NAS workstation network ports can enable network fail over or allow you to aggregate throughput. Teaming is supported either using the Intel ProSet software (when supported) or using built in teaming software, such as the Microsoft Windows features, Switch-Enabled Teaming (SET) and Load Balancing/Failover (LBFO).

One consideration when Teaming network ports are that you can typically only team up to eight ports in each team. For instance, you can team up to four dual-port cards, or team two quad port cards. If teaming with the supported network adapters from the above table, say in a Z8 G4 platform, you could achieve an aggregate 80 Gbps by teaming all eight ports from four Intel X550-T2 cards. This of course would require the utilization of four PCIe slots. As mentioned previously, a customer can elect to have a non-supported card installed through HP Customization Services, for instance integrating four Intel XL710-QDA2 (dual port QSFP+ cards that support 40 Gbps per port) network adapters. Those ports can be teamed to give an aggregate network interface of 320 Gbps.

With whatever teaming configuration you go with, please ensure that the team of network connections can connect to the same switch for best results. When using SET, keep in mind that the teamed ports must be the same type of port for SET to work. For instance, all ports in the team must be X710 ports, or I350 ports. The number of teaming configurations are vast, and teaming is designed to scale as needed (up to eight ports in a team), so you could start your team with two 10 GbE network interfaces, and as the number of users or the network workload increases, you can reconfigure your team/NAS workstation with more ports (that is, until you run out of available switch ports or PCIe slots, of course).

When using the Intel ProSet software, the Advanced Network Services option must be installed to enable both Teaming and Virtual LAN (VLAN). The installer can be found in the Intel Ethernet Package SoftPaq for the platform that you are using. The Intel Ethernet Packages may by default only install drivers, and so to install the ProSet software, you must execute the installer "DxSetup.exe", which can be found under the following file path after installing the SoftPaq: C:\SWSETUP\SPxxxxxx\APPS\PROSETDX\Winx64\DxSetup.exe (where SPxxxxxx is the SoftPaq number for the Intel Ethernet Package).

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Advanced network features

There are many advanced network features that may help you with improving the effectiveness or efficiency of your NAS workstation. Some advanced network features that you may consider looking into include: Internet Small Computer Systems Interface (iSCSI), Intel® Ethernet Flow Director, Receive-Side Scaling (RSS), Message Signaled Interrupts Extended (MSI-X), Stream Control Transmission Protocol (SCTP), Jumbo Packet, Large Send Offload, Receive and Transmit Buffers, and various checksum offloads. It is important to note, that many of these features are enabled by default to improve the default performance, and others are configurable to tune the performance. Also, not all of the supported network adapters support all of the advanced network features listed, so it is best to consult the **Networking Adapters for HP Workstations QuickSpecs** document to confirm what's supported.

One advanced network feature that we will mention in more detail is the Intel® iWARP, which is a software-based Remote Direct Memory Access (RDMA) protocol. Of the supported network adapters, the Intel X722-based products support iWARP, which include the X722 for 1GbE LOM on the Z6 G4 and Z8 G4 platforms, as well as the optional HP Z Dual 10 GbE Network Module, which is only supported on the Z6 G4 and Z8 G4 platforms. Where iWARP comes into play with a NAS workstation is that when enabled and configured properly, the burden of network data transfers on the CPU can be greatly reduced, allowing for more efficient transfers and therefore you may require a less capable CPU compared to if you didn't have iWARP enabled. This may be an important consideration if you are on the fence between selecting a Z4 G4 as a NAS and a Z6 G4, which can support iWARP. In Windows, the iWARP functionality can be exploited through the Microsoft SMB Direct application. Specific to a NAS, the Network File System (NFS) extensions over RDMA (iWARP) application may be of most interest. For more information about iWARP, check out Intel's **iWARP RDMA Here and Now Technology Brief**.

Operating System options

Z Workstations support the most recent Windows 10 distributions, as well as multiple Linux distributions, and so when configuring your NAS, you should keep in mind what's officially supported out of the factory. HP does not have CTO options for Microsoft Windows Server distributions, however it is no secret that our customers have often installed Windows Server OS's on Z Workstations. For official OS support, please refer to the QuickSpecs for the platform you wish to configure.

In this section we will only briefly describe the considerations of each OS option when configuring your NAS workstation.

Windows 10 Pro - Supported CTO

Windows 10 Pro, including Windows 10 Pro for Workstations, is what the majority of Z Workstations ship out of the factory with. Specifically, with the Windows 10 Pro for Workstations, there are some advanced network features, such as SMB Direct and SET, which can enhance your system utilization and performance. Windows 10 in most cases will work for your NAS configuration needs, and being officially supported, you will likely have the best stability with the client OS.

Windows Server

Microsoft Windows Server distributions are not sold or supported on Z Workstations. That said, if you choose to use a Windows Server 2016 or Windows Server 2019 image for your NAS, there are some storage profiles which may aid in deploying and managing your file system. In most cases, the device drivers recommended for Windows 10 will work with both Windows Server 2016 and Windows Server 2019.

A separate technical white paper describes things to consider when installing **Microsoft Windows Server 2016 on a Z Workstation**. Similar installation steps would apply to Windows Server 2019.

Linux - Ubuntu

Ubuntu is an officially supported Linux distribution on Z Workstations and is furthermore certified on the Z8 G4 and Z4 G4 platforms. Whether you run Ubuntu as a Ubuntu Desktop or Ubuntu server, it may provide just the right amount of OS support for your NAS workstation needs. On top of Ubuntu, Ceph is a storage solution with the flexibility to serve up a scalable NAS configuration. These solutions are merely mentioned in this paper as suggestions to look into further, and if Linux is a strong consideration for your NAS workstation, we would encourage you to visit ubuntu.com, and furthermore look into running Ceph on Ubuntu.

- **1** Executive Summary

- 2** Why someone might use a Z Workstation as a Network Attached Storage workstation

- 2** Z NAS as part of the ZCentral solution

- 3** NAS Architecture overview

- 4** Platform options to consider

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- 10** Ordering your Z NAS system

Open Source Storage Server OS

Although not officially supported OS's, you may also want to consider **FreeNAS** or Apache's **Hadoop** Distributed File System (which can run on top of an officially supported OS, such as Ubuntu), as free and open-source OS's to run on your NAS workstation. Again, these are merely mentioned as options to look into when considering the right NAS workstation configuration for your needs.

Ordering your Z NAS system

For now, HP does not offer configurations that are specifically designed to be used as a NAS workstation. This is in part due to the large number of permutations and use models that a NAS workstation can be deployed with. This is partly why this White Paper is being published. HP is here to help guide you in your journey of configuring and deploying your NAS workstation, and we encourage you to reach out to your local HP Sales Representative. If your HP Sales Representative cannot answer your questions, then there is a team of Technical Consultants to help you determine the best configurations for your workflows.

The CTO options for each platform is limited in that most CTO offerings are designed for single-user workstations. That does not mean that you cannot order a rich NAS configuration to be delivered from the factory. You may find that if you need to go beyond the CTO configurability, then you may want to use HP Configuration Services to get exactly what you need, including adding 3rd party hardware not otherwise supported by HP. So when you go to order your NAS workstation, keep in mind that your options are not limited to what's available on HP.com, and you are encouraged to reach out to an HP Sales Rep to discuss options.

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